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RURAL AMERICA AT THE CROSSROADS: NETWORKING FOR THE FUTURE

Summary

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CONGRESS OF THE UNITED STATES
OFFICE OF TECHNOLOGY ASSESSMENT

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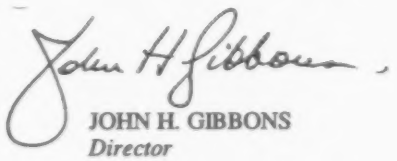
Foreword

Rural America is at the proverbial crossroads. Many rural communities show signs that raise concern for their future: loss of economic vitality, a relative decline in income, high unemployment, low workforce participation, and an exodus of talent. Advances in communication and information technologies, however, hold promise for rural America, by reducing the barriers of distance and space that have disadvantaged rural areas. Rural businesses can now link to other businesses or access major markets, even in other countries, just as readily as those in urban areas, while still enjoying the many distinctive benefits of rural living.

This study explores the role that communication technologies can play in securing rural America's future. It develops several policy strategies and options to encourage such development. The study was requested by the Joint Economic Committee of Congress and Senators Charles E. Grassley and Orrin G. Hatch.

OTA gratefully acknowledges the contribution of the advisory panel, workshop participants, contractors, reviewers, and many others who provided information, advice, and assistance. However, OTA bears sole responsibility for the contents of this report.



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NOTE: OTA appreciates and is grateful for the valuable assistance and thoughtful critiques provided by the advisory panel members. The panel does not, however, necessarily approve, disapprove, or endorse this report. OTA assumes full responsibility for the report and the accuracy of its contents.

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Summary and Policy Conclusions

Introduction

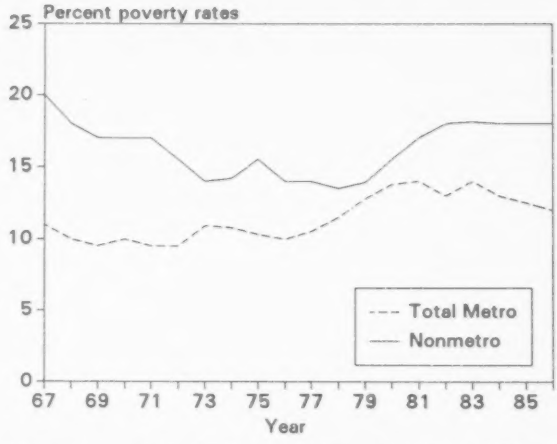
Rural communities have played a central role in American life. Politically, they have served as the centerpiece of American democratic thought. Economically, they have provided the labor, food, and other natural resources that fueled and sustained the industrial revolution. Now comprising 24 percent of the Nation's population and 28 percent of its labor force, rural areas continue to be a source of inspiration and sustenance. In the minds of many, these communities reflect and reinforce the traditional American values of community and individualism. Increasingly, they are viewed as a haven from the intractable problems caused by urban development.

Notwithstanding their basic strengths, many rural areas today show signs and symptoms that raise concern for their futures. These include a loss of economic vitality, a relative decline in income, high unemployment, low workforce participation, and a high level of migration out of rural areas. Thus we find that per-capita income in rural areas is much lower than in urban areas, and that the communities considered to be the most rural are the worst off. Rural poverty rates, having been on an upswing since the early 1970s, are also higher than urban poverty rates (see figures 1 and 2).

Rural areas are showing a loss of economic vitality, a relative decline in income, high unemployment, low workforce participation, and a high level of outmigration.

A number of forces underlie the problems that now beset rural communities. These forces are structural in nature, so they are unlikely to be easily reversed. One of the most important forces is the dramatic shift in the economy away from the production of primary resources and manufactured goods towards the provision of services. Since rural areas are more dependent on these declining sectors,

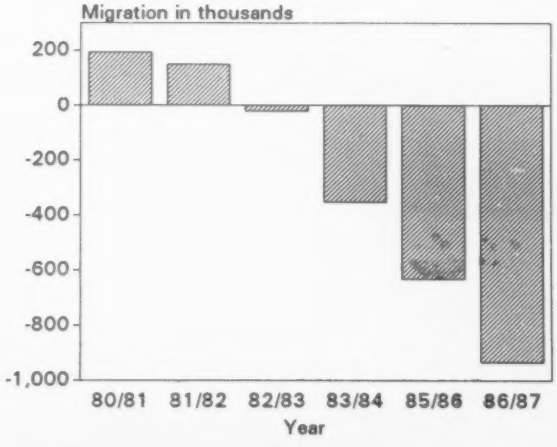
Figure 1—Poverty Rates by Residence*



*Metro and nonmetro for 1985 based on the Census of 1980, for 1969 and 1971-83 on the 1970 Census, and for earlier years on the 1960 Census. No 1984 data.

SOURCE: Bureau of the Census, Current Population Survey, as cited in U.S. Department of Agriculture, *Rural Economic Development in the 1980's: Prospects for the Future* (Washington, DC: U.S. Department of Agriculture, 1988), p. 12.

Figure 2—Nonmetropolitan Net Migration*



* For 1980-83, nonmetropolitan counties are as defined in 1970; 1984 definition is used thereafter (noninstitutionalized population).

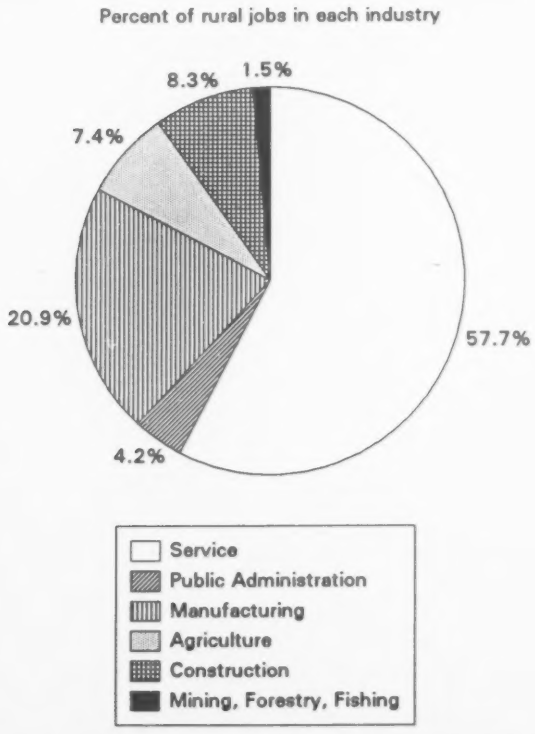
SOURCE: U.S. Bureau of the Census, as cited in U.S. Department of Agriculture, *Rural Economic Development in the 1980's: Prospects for the Future* (Washington, DC: U.S. Department of Agriculture, 1988), p. ix; U.S. Department of Commerce, *Geographic Mobility: March 1986 to March 1987* (Washington, DC: U.S. Bureau of the Census, 1989), series P-20, No. 430.

Advances in communication and information technologies coincide with a shift toward a more service-oriented economy.

they are especially vulnerable to this shift (see figure 3). With the emergence of a global economy, and the rise of the newly industrialized countries, rural areas are facing intense competition in resources and primary manufacturing from abroad.

Not all trends are necessarily negative. Tremendous advances in communication and information technologies, and radical changes in the way these technologies can provide services have occurred along with the shift toward a more service-oriented economy. Many people believe that these developments hold promise for rural America, because

Figure 3—Employment of Rural Residents, 1988



SOURCE: U.S. Department of Commerce, *Rural and Rural Farm Population: 1988* (Washington, DC: U.S. Bureau of the Census, 1989).

Photo credit: Mark G. Young

An uninhabited shack in a ranching community in rural Colorado.

communication technologies reduce the importance of distance and space—two factors that disadvantage rural areas. Rural communities with modern communication technologies can more easily deal with their problems. Using advanced communication technologies, for example, a rural business can link to other businesses, or access major markets, just as easily as a business in an urban area.

Other observers are less sanguine about the impact of technological developments on rural America, because communication networks work in two directions—they could undermine rural economies rather than bolster them. Skeptics warn against being too fixated on technology, because technology, by itself, cannot bring about development.

Economic development requires the coming together of a wide array of people, skills, and resources. How, and the extent to which, new communication technologies can be used to improve the prospects for success depend on a number of factors. This study defines the role of communication in the development process and develops several criteria for policy strategies and options that encourage such development. Policy options that meet these criteria are outlined and discussed.

Request for the Study

This study was requested by the Joint Economic Committee of Congress and by Senators Charles E. Grassley and Orrin G. Hatch. Noting that the widespread deployment of communication and information technologies will inevitably bring major changes in the way all Americans live and work, the

Economic development requires the coming together of a wide array of people, skills, and resources.

committee asked OTA to examine how these developments might affect economic conditions in rural America. The questions that the committee asked OTA to address are:

- Will technological advances be available in a timely manner to rural America?
- Does information-age technology involve economies of scale and scope that will enable rural businesses and communities to adopt these technologies?
- What are the expected economic effects of information-age technologies in rural areas, particularly on employment (including job creation, training needs, and job displacement) and investment (including capital requirements and public infrastructure)?
- Which rural areas are likely to have the greatest ability to make use of these new technologies?
- What roles can the various levels of government play in fostering information-age technology?
- Can rural America expect to be competitive in serving national and international markets for the goods and services of this new era?

What Are the Stakes?

The Stakes for Rural America

Although often isolated and remote, America's rural communities do not exist in a vacuum. They will inevitably change as the world around them changes. As communication technologies extend rural ties and expand rural markets, these communities will become increasingly vulnerable to national and global trends and events. For rural America, the most critical of these developments will be the adjustment to a highly competitive, service-based, global economy and the emergence of major, worldwide environmental concerns that will compel them to reorient their economies. Since many rural communities lack essential financial and human resources, and often depend on a single industry for the lion's share of their wealth and vitality, their ability to adapt to these changes is limited. Without some form of intervention, these communities are headed for decline.

Photo credit: Mark G. Young

A study in contrast: a new house with a satellite dish abuts an abandoned adobe hut in Garcia, Colorado.

If these technologies are to enhance the economic prospects of rural areas, then policymakers must develop policies to create the most favorable conditions for their use to go along with policies that promote technology deployment.

Advanced communication and information technologies are certainly not "the" solution to the many problems confronting rural America. In fact, one needs only to look historically to see examples where the deployment of these technologies has left rural communities worse off. However, in the current economic environment, in which businesses are using these technologies strategically to gain a competitive advantage, communities and businesses that have limited access to them are unlikely to survive. While not a panacea, in a global, information-based economy, these technologies could help rural communities overcome a number of the barriers that have limited their economic well-being in the past.

Precisely because communication technology is a mixed blessing and often functions as a double-edged sword, it is essential that decisionmakers clearly understand, and take into account, not only the benefits and costs associated with this technology, but also—and perhaps more importantly—the socioeconomic conditions under which the benefits

Box A—Telecommunications for Business

Each of Edward D. Jones & Co.'s offices is a far cry from Wall Street—from the hustle and bustle, maybe, but not from the stocks and bonds. Jones & Co. is a full-service brokerage house specializing in low-risk securities serving mainly rural communities and towns with fewer than 20,000 people. The company uses advanced telecommunications to deliver big-city financial services to smaller towns and rural communities.

When Jones & Co. initially branched out from its main office in Maryland Heights, MO in 1955, it relied on teletype machines to connect its separate one-person offices to the headquarters. By 1980, when the company had completely switched over to computers, it had grown to some 300 retail branches. In the 10 years since, Jones & Co. has mushroomed to nearly 1,600 offices in 44 States, and has upgraded the computer hardware and software as growing demand has outpaced the capacity of the successive systems. With more retail offices than any other financial services company in the United States, Edward D. Jones & Co. earned $249 million in revenues in 1989.

More recently, Jones & Co. invested $30 million in 1988 to install a private two-way satellite network to link its dispersed and numerous offices that went online in 1990. With rising costs of local and long-distance communications services, which can be a particular problem in rural areas, the very small aperture terminal (VSAT) satellite system gives the company greater control of its telecommunications and stabilizes these costs. Jones & Co.'s computer network has links to banks to expedite crediting clients' accounts, insurance companies, mutual fund firms, and information services such as Standard & Poor's MarketScope service. With VSAT's video capacity, Jones & Co. is able to broadcast live product presentations or training sessions between sites. The VSAT technology also permits the company, which plans to expand to 3,000 offices by 1991, flexibility in adding or moving branch locations.

SOURCES: Robert Cullen, "Trial by Fire," Edward D. Jones & Co. press package; Edward D. Jones & Co., "Satellite Technology Brings Wall Street to Main Street," press release, undated; Edward D. Jones & Co., "Edward D. Jones & Co. Sees Technology As Key to Rapid Growth," press release, undated; as cited in MESA Consulting, "Telecommunications and Rural Economic Development," prepared for United States Telephone Association, October 1990.

are most likely to be realized. If these technologies are to enhance the economic prospects of rural areas, then policymakers must develop policies to create the most favorable conditions for their use to go along with policies that promote technology deployment.

Market as well as government decisions determine how communication technologies will be deployed in the future. Rural America clearly has tremendous stakes in the outcomes of these decisions. Certain courses of action can provide rural communities an opportunity to gain greater control over, and perhaps reverse, the direction in which they are headed. Other actions are likely to foreclose this possibility.

The National Stakes

Whether rural communities experience development or decline is not merely a local concern. All Americans have a stake in how well rural communities cope with, and take advantage of, the rapidly changing environment in which they find themselves. The kinds of economic activity that occur in rural America can have a significant impact on the Nation's overall prosperity.

Long-term economic development requires the continual flowering of new centers of innovation. As we increasingly realize, such innovation takes place primarily in relatively small local enterprises.[1] Most rural areas, however, have been forced to play a supportive role in this process. With their long distance from commercial centers, and their sparse populations, the small communities in these areas have generally been unable to assemble the skills, information, and capital required for development to take place. These barriers of distance and space are likely to be much less formidable in the future. By taking advantage of advanced communication and information technologies, rural communities may find it easier to access and assemble the resources that foster innovation and growth in city regions. Equipped with communication and information technology and the wherewithal to take advantage of

[1]See for discussions, Jane Jacobs, *Cities and the Wealth of Nations* (New York, NY: The Viking Press, 1985); Michael J. Piore and Charles F. Sabel, *The Second Industrial Divide: Possibilities for Prosperity* (New York, NY: Basic Books, 1984); and David Osborne, *Laboratories of Democracy* (Boston, MA: Harvard Business School Press, 1988).

Economic development in rural areas will not only affect national economic performance, it will also help determine how well the United States fares in an increasingly competitive, global economy.

it, rural communities can be viewed not as potential problems, but rather as untapped national resources (see box A).

Economic development in rural areas will not only affect national economic performance, it will also help determine how well the United States fares in an increasingly competitive, global economy. Since 1970, the U.S. trade position has steadily worsened, while those of our major competitors continue to improve. Much of the increased trade competition is in the area of primary goods and low-technology industries—the industries in which rural areas have traditionally specialized. Rural areas can contribute to an improvement in the U.S. trade balance if economic development in these areas leads to greater economic diversification and/or a shift to those industries—such as services and high-tech manufacturing—that are growing in demand worldwide.

Rural economic development can contribute not only to the national economy, it can enhance the overall quality of national life. If rural communities use new technologies to diversify their economies, becoming less dependent on the production of primary resources, they may make less of a claim on the Nation's environmental resources. Communication technologies can also be used to substitute for travel, thereby conserving energy and reducing air pollution.

The economic viability of rural communities will determine the extent to which these areas can provide an amenable lifestyle and a counterbalance to the pull of urban implosion. Many urban regions suffer from problems of overdevelopment: congestion, pollution, crime, high costs of living, etc. Rural areas might provide a means of escape if there were sufficient amenities, such as good schools, adequate health care, and cultural activities. Many elderly are taking advantage of the benefits of rural living by moving to retirement communities established in these areas.

Key Findings

The Diversity of Rural Areas

Although rural communities share a number of common problems, many of their individual characteristics, and the local resources they can draw on to address their problems, are very different.[2] One community's strength may be another's weakness. Communities are often endowed differently with respect to their locations, landscapes, and natural and human resources, as well as access to communication and information technologies. For example, Kentucky's location in the center of the United States makes it attractive to foreign capital; New Mexico's Native American and Hispanic populations lend support to a prospering tourist trade; while the forests of Washington State and Maine supply raw materials for the Nation's timber industry. Because of such differences, rural communities will need to pursue a variety of development approaches.

New Ways of Thinking About Communications in Rural Areas

Ironically, at the moment when communication and information technologies are beginning to play a critical role in business, the regulatory structure that once provided rural areas equal access to these technologies is coming unraveled. Divestiture of the Bell System and the shift towards deregulated services, together with the emergence of large

Divestiture of the Bell System and the shift towards deregulated services, together with the emergence of large private networks, are undermining the traditional system of rate averaging and subsidies for local telephone service.

[2]To capture this diversity, and to better understand its implications for Federal policy, OTA conducted field studies in four States—Kentucky, New Mexico, Washington, and Maine.

Photo credit: Mark G. Young

El Morro, New Mexico.

private networks, are undermining the traditional system of rate averaging and subsidies for local telephone service. These developments have occurred at a time when rural economies are themselves becoming more fragile, and when—given the trend towards a service-based global economy—their information and communication needs are now more important than they have ever been.

If rural areas are not to experience further decline, measures must be taken to assure that they have access to the needed infrastructure. However, the previous means for providing infrastructure to rural areas is no longer sustainable, because of rapid technological change and a more competitive industry environment. Thus, it is time to devise new ways of designing communication systems and delivering communication services to rural areas.

A Rural Area Network would link up as many users within a community as possible—including among them businesses, educational institutions, health providers, and local government offices.

The divestiture of the Bell System and recent technological advances provide a number of new opportunities to do this. Most important is the unbundling of the communication infrastructure,[3] and the subsequent development of new network architectures and new technologies and technological applications.

With unbundling, users no longer must buy services as a single unit. Now they can purchase services separately, on a piece-by-piece basis, configuring them to meet their own particular needs. Many businesses are taking advantage of this capability to develop their own private communication networks.[4] Increasingly they are connecting their various departments through local area networks (LANs) and their offices through metropolitan area networks (MANs) or wide area networks (WANs) (see box B). As the information and communication needs of these businesses become more specialized, so too are their communications systems. For example, banks and other financial institutions have developed specialized communication services, such as the Society for Worldwide Interbank Financial Telecommunications (SWIFT), and manufacturers have developed their own communications protocols, such as the Manufacturing Automation Protocol (MAP). Even system integrators are beginning to specialize in providing networking services.[5]

Just as businesses are taking advantages of these developments to create their own customized communication networks, so too might rural communi-

[3]Unbundling first appeared in telecommunications with the FCC's Carterfone decision of 1968, which allowed customers to add equipment to their telephones as long as they did not adversely affect the operation of the telephone system or its usefulness to others. The development of open network architecture (ONA) will lead to the further unbundling of the telephone network. If pursued far enough, open architecture would allow independent providers and others to purchase the most elemental functions. They could also create their own products, reconfiguring and customizing these functions to meet their own needs.

[4]In the past, one telecommunication network existed to provide universal service to all users. This arrangement was quite suitable, as users' needs were very similar and the services that could be offered were relatively limited. Businesses used the telephone for voice communication in much the same way that households did. Today, this is no longer the case. Different kinds of businesses increasingly have different kinds of business needs.

[5]For a discussion, see Eli M. Noam, "The Future of the Public Network: From Star to the Matrix," *Telecommunications*, March 1988, pp. 58-59, 65, and 90.

Box B—LANs, WANs, and MANs

Local Area Networks (LANs): LANs are data communication networks that are relatively limited in their reach. They generally cover the premises of a building or a campus. Like all networking technologies, LANs facilitate communication and sharing of information and computer resources by the members of a group. Within the business community, the number of LANs deployed has recently grown by leaps and bounds. Predictions are that in 1992 the number of LANs deployed will surpass 5 million, and more than one-half of all PCs will be connected by LANs.

Wide Area Networks (WANs): Wide area networks are data communication networks that provide long-haul connectivity among separate networks located in different geographic areas. Many businesses are using WANs to extend and restructure their operations on a national or worldwide basis, while at the same time gaining the economies of scale and scope that can be achieved by large-scale, shared networks.

WANs make use of a variety of transmission media, which can be provided on a leased or dial-up basis. WANs can also be privately owned. Recently, many businesses have chosen satellite networks, taking advantage of the recent development of relatively low-cost small aperture terminals to link their various offices to a headquarters facility. General Motors is planning to build the largest network of this kind. Scheduled for operation in 1992, it will consist of 9,700 very small aperture terminals that will connect GM locations nationwide.

Metropolitan Area Networks (MANs): Still in the field-testing stage, metropolitan area networks provide switched data networking services at very high speeds (45 to 50 megabits per second) within a geographic area of at least 50 miles. MANs connect LANs to LANs, as well as LANs to WANs. As designed by Bellcore, MANs will provide Switched Multimegabit Data Services (SMMDS), which will allow users to set up a virtual (or logical) private network, and give them access to individual services on demand. These networks are designed for shared usage.

SOURCE: Office of Technology Assessment, 1991.

ties. However, whereas many business networks are established along functional lines, Rural Area Networks (RANs) would be configured, instead, around the geographic boundaries and needs of an entire community. Designed on the basis of a ring (or campus-type) architecture, a RAN would link up as many users within a community as possible—including among them businesses, educational institutions, health providers, and local government offices (see figure 4). Rural Area Networks could be linked statewide, perhaps by piggybacking on the State government and/or the State educational networks.

Rural Area Networks have a number of potential benefits:

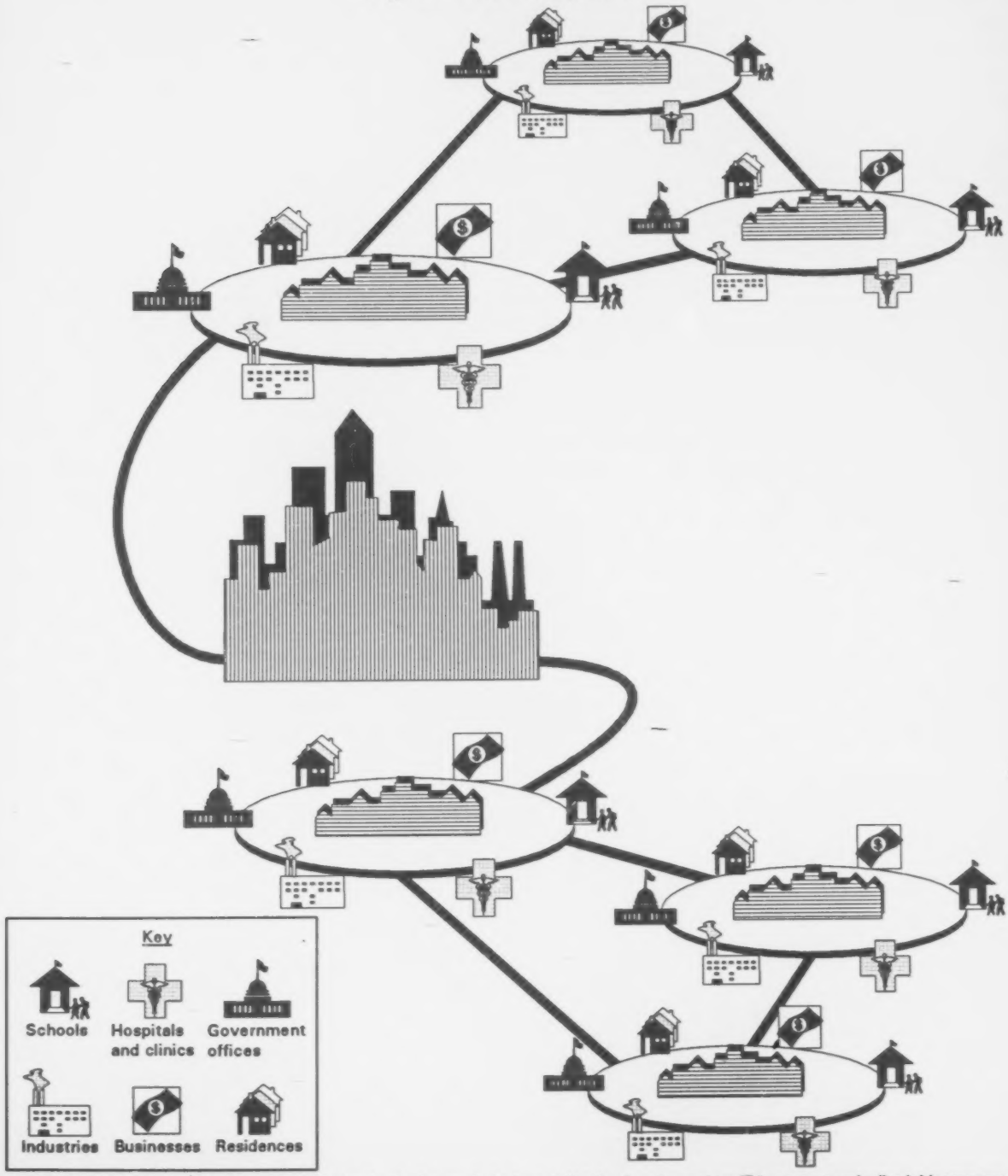
- RANs could foster the deployment of advanced technology to rural areas in an economically viable manner. By pooling diverse users, they would provide considerable economies of scale and scope.
- Built to meet shared needs, they could foster cooperation and community ties.
- RANs would overcome the limitations of technological expertise in rural areas since they could be designed by one systems integrator.
- RANs would induce communication providers to be more responsive to the communication needs of rural communities. By joining forces, rural users will be able to exert greater leverage in the marketplace.

Wider Technological Choice

In creating such networks, rural communities can choose from a variety of technologies, particularly new technologies such as digital radio and advanced satellites as well as niche markets for old technologies, each of which have special applications for remote, rural areas. Many of these technologies are radio-based so their cost depends more on total demand than on population density.

With digital radio, for example, cable is not required beyond the Radio Carrier Station; each subscriber has a radio transceiver that provides a standard phone service drop. Whereas it can cost on average about $10,000 per subscriber to provide access lines via copper wire, the average cost today with digital radio is about $3,000 per subscriber. Digital radio systems capable of carrying four DS-3 (each transmitting at 45 megabits per second) lines are expected to be available in the early 1990s.

Figure 4—Rural Area Network



A Rural Area Network would be designed to foster the deployment of advanced technology to rural areas in an economically viable manner by pooling the communication needs of a community's many users—especially the businesses, educational institutions, health providers, and local government offices.

SOURCE: Office of Technology Assessment, 1991.

If rural communities are to make use of an assortment of technologies to create Rural Area Networks, they must develop strategies to optimize the advantages of each and make them work together.

Advances in satellite technology also hold considerable promise for rural areas. Because satellite-based signals are broadcast over a wide area, virtually any user within the satellite's "footprint" can easily access the network at the same cost. The mobile satellites being designed now for launch in the early 1990s will have sufficient power to enable the use of a large number of small, mobile terminals on the ground. Portable units will be self-contained and lightweight, capable of fitting on a company or family car. These terminals will allow the user to connect with private networks or the public telephone network for a variety of services, including voice, data, facsimile transmission, and computer-to-computer communications. Most recently, Motorola is developing a global, satellite-based cellular network technology, called Iridium, that, once operational, could greatly reduce the cost of delivering communication services to rural areas.

Technological advances have also reduced the cost of deploying wireline communication services to rural areas. For example, the development of remote digital switching modules now permits carriers to use fewer expensive host switches to provide advanced intelligent services such as access to 800-number databases. The cost savings can be substantial. One host switch, such as the AT&T 5SEE, costs approximately $510 million, whereas a remote switching module will cost between $600,000 and $700,000.

The Need for Greater Technological Expertise

If rural communities are to make use of an assortment of technologies to create Rural Area Networks, they must develop strategies to optimize the advantages of each and make them work together. These are by no means easy tasks. Nor does the average rural businessman or woman have the experience, skills, and resources to do this.

Under the old Bell System, few subscribers were required, or even inclined, to explore their service options. Thus, today, many are unprepared to sort out the many options available to them in an industry environment driven by rapid technological change. Taking the time out from normal business operations to come to terms with information-age technologies is also difficult. Most rural businesses are small; job responsibilities are not specialized enough so that any one person could devote much time to become a communication expert. As one rural businessman said: "I run my business on a shoestring. I supervise operations; keep the books; and even sweep the floor. When would I ever have time to learn about how to use communication strategically?"

Nor are there many people to whom rural businesses can turn for help. In a competitive environment, many communication vendors are focusing their energies on the needs of the much more lucrative large business users. Among those who have supported small rural businesses in the past—such as agricultural extension agents, economic development officials, or the local chambers of commerce—few recognize or understand the economic development opportunities that new technologies offer. It is not surprising that when a rural business, or a rural community, has been successful in deploying new technology effectively, there has generally been a knowledgeable, energetic, and visionary individual involved.

Enhanced Technology Requirements

In taking advantage of the new technological capabilities, businesses are changing the way they conduct business. More and more, they are using technology to gain a competitive strategic advantage. For example, as in the case of electronic data interexchange (EDI), communication technologies are being used to gain competitive advantage over competitors (see box C). Within companies they are being used to improve the efficiency and effectiveness of business operations. In addition, they are being used as a basis for creating new products and services. For this reason, it is imperative that rural communities not be left behind technologically.

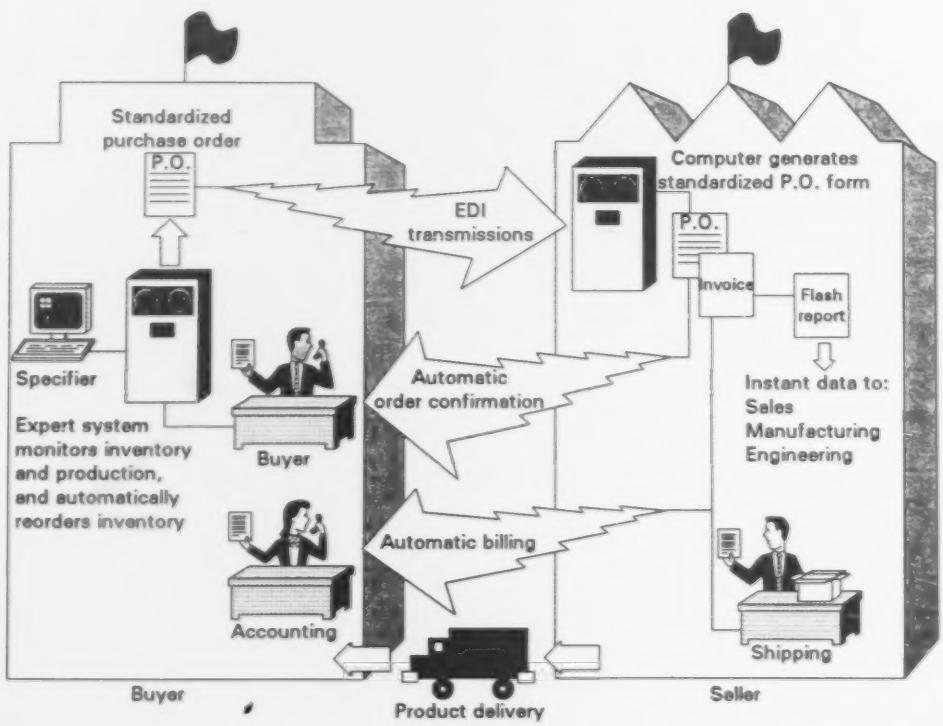
It is not clear, however, just what level of technological deployment is needed for rural areas to keep pace. Many of the services that will likely be required by an individual rural business could be

Box C—Electronic Data Interexchange

Electronic data interexchange (EDI) is a notable example of how information and communication technologies are emerging as important strategic tools for efficient and effective business operations. EDI is essentially the modern, computer-based method by which companies order, invoice, and bill their products and services. Such common transaction functions as invoices, shipping notices, and bills, which traditionally have entailed the transfer and processing of paper documents, are replaced by electronic transfers between the businesses' computers.

Electronic data interexchange improves the efficiency and effectiveness of operations by empowering businesses to purchase supplies and to produce and distribute products precisely when and where they are needed. The company's computer system, for example, will initiate a purchase order and execute the purchasing transaction when an item is requested and removed from the inventory. The price, terms, and conditions of the contract are all stored in the computer. In addition to the considerable savings gained as inventory costs are reduced, EDI also minimizes human clerical error and the considerable processing costs involved with paper transactions. By reducing or eliminating the prolonged and often error-plagued paper trail, large retailers and manufacturers are able to gain a competitive advantage by streamlining transactions with their suppliers and buyers.

SOURCE: Office of Technology Assessment, 1991.



How electronic data interexchange internally and externally expedites business transactions.

SOURCE: Reprinted from *Datamation*, Mar. 15, 1988 © 1990 by Cahners/Ziff Publishing Associates, L.P.

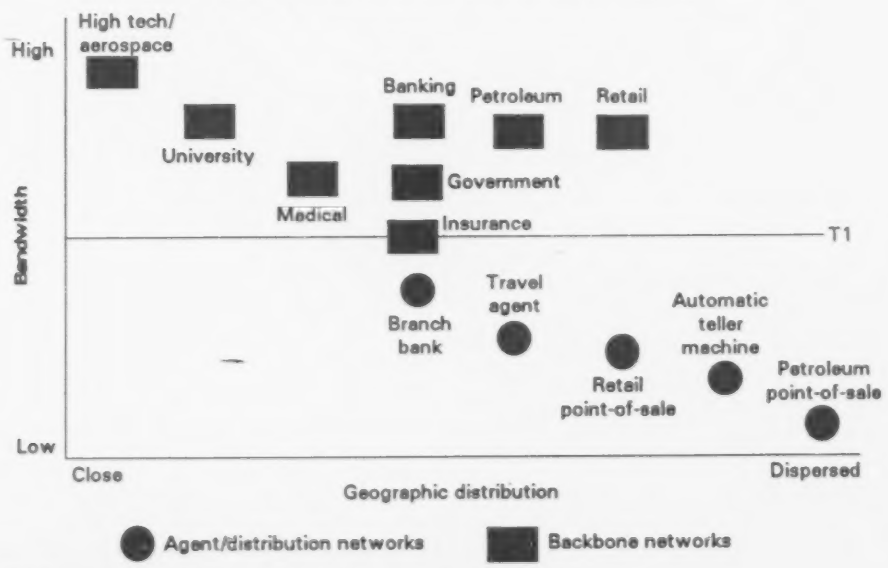
provided with narrowband (64 kilobits per second to 1.5 megabits per second) capacity (see figure 5). However, if rural businesses pool their communication needs, they can benefit from the same kind of efficiencies that large businesses enjoy by using broadband technology (1.5 to 45 megabits per second).

In evaluating a rural community's technological requirements, one must not only consider a community's own economic activities, but also—and increasingly—the activities of its competitors.

In an information-based economy, communication needs are relative. In evaluating a rural community's technological requirements, one must not only consider a community's own economic activities, but also—and increasingly—the activities of its competitors, whether they be businesses in urban areas or in other countries. Estimating rural needs in relationship to its competitors is, however, a very complicated and uncertain task. There is currently not a consensus about the capabilities large business users need, and within what time frame. Nonetheless, it is clear that the deployment of advanced technology in rural communities is likely to lag well behind that in urban areas. With few exceptions, communication vendors are focusing their development and marketing efforts on the large, lucrative business customer, instead of bringing advanced technology to remote areas.

Regulatory policy reinforces this situation. Regulators generally do not focus on promoting economic development, so they do not view rural needs in relative terms. Instead, they tend to consider needs for the present, evaluating them on an individual user, service-by-service basis. Accordingly, they contend that the needs of most rural businesses can be met by deploying narrowband capabilities ranging from 64 kilobits to 1.5 megabits, which later can be upgraded to broadband capabilities of 45 megabits. From the regulators' point of view, infrastructure modernization should focus on immediate problems such as assuring that all subscribers have single-party lines, digital switching facilities, and touch-tone dialing.

Figure 5—Bandwidth Requirements in Industry



Bandwidth requirements for different types of users.

SOURCE: Mary Johnston and James Herman, "Two Tracks to the Future of Private Networks," *Business Communications Review*, April 1990, p. 18. Reprinted with permission of publisher, Business Communications.

Photo credit: Mark G. Young

An example of the importance of information technologies in rural areas: fax service in Espanola, New Mexico.

This approach is inappropriate for the development of community-based Rural Area Networks. Networks that seek to pool business needs or that use communication technologies to address social needs as well as business concerns will require broadband capacity. The State of Maine's education network already uses three DS-3 lines, and this capacity will likely not suffice for long. The State of Michigan also plans to deploy a statewide broadband network.

In such situations, an evolutionary approach to network modernization would be unwise. Broadband technology is optimally designed for sharing. It provides new ways of organizing communication networks, and is not a mere extension of narrowband technology. Upgrading can be costly. The amount of capital available for network modernization is particularly limited in rural areas, so care must be taken to assure that investments made now do not preclude the timely installation of more advanced technologies in the future.

Joining Technology Policy to Economic Development Policy

Notwithstanding the many opportunities that new technologies afford, technology, in and of itself, cannot level the playing field for rural areas and their urban and global competitors. The lack of effective communication links is only one of a number of barriers to economic development. Other barriers—which in many cases are more crucial and immediate—include social problems such as low educational attainment, extreme poverty, and poor health conditions, as well as inadequate physical infrastructure and a shortage of capital. If economic development in rural communities is to be self-sustaining, these problems must be addressed as well. What is required is a holistic approach to economic development that incorporates the idea of comprehensive community development. In most cases, communication technologies can foster and support such an approach; they can be used to provide education, deliver health care, and strengthen local government (see box D). However, to make the most of new technologies, technology deployment and economic development policy need to be joined.

Many benefits can be lost when technology deployment takes place in response to market demand rather than as part of a comprehensive economic development program.

Failure to link the deployment of communication technology to a program for comprehensive economic development could actually harm rural communities. By all measures, whether they be poverty rates, income levels, or levels of educational attainment, rural areas begin from a disadvantaged position *vis-à-vis* urban areas. As the history of communication technology shows, under such circumstances, the mere deployment of technology may expose rural economies to urban competition and hence widen the economic gap rather than narrow it (see box E).

It is only by pooling public and private demand that advanced communication systems can be economically deployed to rural areas.

The impact of mass media on rural businesses provides a good example. The explosive growth of popular magazines intensified competition for ad-

Box D—Technology and Health

The health care crisis in America is an especially acute problem for rural communities. The closing of hospitals and medical facilities and the rising costs of medical insurance pose a serious threat to rural communities and their economies. In Texas, for example, 73 hospitals have been forced to close since 1984; the majority of these served rural communities. To overcome this potentially disastrous trend, Texas Tech University is designing and implementing several telecommunications-based programs to help deliver medical services to rural hospitals, clinics, and practitioners. The University's 4 campuses serve 108 counties and 135,000 square miles in western Texas with a population of 2.5 million people.

The University's Health Services Center launched the Kellogg-Affiliated Remote Environments Network (KARENET) in 1985 to afford doctors in rural west Texas access to vital support mechanisms. KARENET is an online computer network that rural physicians and medical professionals can access by telephone and modem for such programs as recording and monitoring patient care information, consulting with up-to-date treatment procedures and protocols, health-care research, and continuing medical instruction. With $2.4 million funding from the W.K. Kellogg Foundation and with computer support from AT&T, KARENET creates a "medical telecommunity" that benefits the rural hospitals by retaining more patients and benefits the patients by reducing the costs and problems associated with travel.

The Health Services Center also operates MEDNET, a 3-year project "to demonstrate the use of interactive telecommunications systems to link rural hospitals, clinics, and practitioners, with the purpose of improving rural health care by using technology to overcome professional isolation." Funded by a $1.9 million grant from the U.S. Department of Health and Human Services, MEDNET involves several technologies that provide an array of important medical services:

- Two-way interactive video—along with voice, graphics and data—carried over digital T1 telephone lines enables "[t]he primary care physician in the rural hospital [to] communicate with physicians in larger hospitals or medical centers for consultation and diagnosis."
- Personal computers donated by AT&T and special modems (codecs) are used to transfer x-ray images and pathology slides as well as for other office functions such as word processing, spreadsheets, billing, appointments, and record keeping.
- A satellite-delivered continuing education curriculum gives physicians, nurses, and health-care professionals programs that are specially tailored to address rural health concerns. The satellite broadcasts the video program to the 22 participating rural hospitals while a telephone connection completes the two-way audio portion.
- A telefacsimile network that supports 19 hospitals has been particularly useful in requesting and receiving materials from the Health Service Center Libraries and for consulting.

Twelve sites were originally chosen to receive the satellite downlink and display equipment to take part in the continuing education program under the initial grant funding. Others have joined subsequently, and the satellite education project can, according to Jeffrey Cowan, become self-sufficient. For other of MEDNET's program, the expense of the equipment is often a considerable burden for rural facilities, so that seed money and outside funding will be an important determinate to success.

SOURCES: John M. Holden, "Across the Phone Lines," *American Medical News*, Jan. 27, 1989, p. 13. Executive summary, the Texas Tech MEDNET demonstration Project, Texas Tech University Health Services Center, School of Medicine, Lubbock, TX. KARENET Pamphlet. Personal correspondence, Jeffrey Cowan, Satellite Communication Specialist for the MEDNET project, Jan. 10, 1991.

vertising among segments of the publishing industry, and the winners in this competition matched the shifts in the Nation's marketing system. The small, local retailers, who had once served their communities with little competition, suddenly faced a succession of new challengers—department stores, mail-order firms, and chain stores. The metropolitan press increasingly tied its fortunes to department stores and chains; and magazines were well-positioned to run advertisements for nationally marketed consumer goods that were sold through all kinds of outlets.

Many benefits can be lost when technology deployment takes place in response to market demand rather than as part of a comprehensive economic development program. It is only by pooling public and private demand that advanced communication systems can be economically de-

Box E—Technology and Culture

The Zuni Indian Reservation, some 150 miles due west of Albuquerque, lies in New Mexico's dramatically stark and strikingly wild country on the border of Arizona. It is a short way down the road from Gallup, the principal trading center for the huge Navajo Indian Reservation. As on other reservations, unemployment and attendant social problems are severe. The primary source of commerce in Zuni is trade in traditional hand-crafted jewelry.

There is very little about the Zuni Middle School that sets it off from other rural schools. It is housed in a modest and modern one-story, red-brick building. The school children at the middle school wear name-brand sneakers and T-shirts emblazoned with the names of popular music stars—evidence, we are told, of the profound effect of Home Box Office (HBO, the subscription movie broadcaster) and Music Television (MTV, the popular music video channel). However, while the students are exposed to mainstream popular American culture through TV and satellites, the middle school's Language Literacy Center is creating a computer program to help teach the native language to the students, many of whom are only familiar with the language in spoken form and are unable to read or write it. The project is an example of the application of technology to preserve and reinforce culture.

Education is something of a mixed blessing: because the Reservation does not have the resources to satisfy those students who become interested in further education, they are thus inclined to leave and often relocate where the opportunities are commensurate with their ambition and ability. Yet the middle school's Language Literacy Center, with the support of Apple Computers, is entering the Zuni language on HyperCard, a user-friendly application that enables the student to quickly and easily switch between menus and topics as a way of cross-referencing material. The user learns to associate the pronunciations of words and sounds with the spelling. Several lessons, for example, are taught through short stories, and the student can look up an unfamiliar word by switching to the program's dictionary or alphabet.

SOURCE: Office of Technology Assessment site visit, 1990.

A sample menu from the Literacy Center's computer program.
SOURCE: Language Literacy Center, Zuni Middle School.

Federal telecommunications policy is often at odds with States' economic development goals.

ployed to rural areas. Moreover, there are a number of positive synergisms to be gained from linking technology deployment to development policy. Communication vendors will learn more about economic development, while community leaders will gain a greater understanding of the technology. With such cross-fertilization, new development approaches and innovative technological applications could emerge. In addition, with the benefits of sharing communication resources, key individuals and groups that have previously operated independently will find opportunities to cooperate on behalf of their community's development.

The Role of Telecommunications Policy

Successful rural economic development strategies require that communication regulatory policy have parallel—if not consistent—goals and approaches. For example, if economic development goals include the provision of education and health services, then regulatory cost/benefit analysis must include the social benefits of these services in their calculations. This currently is not the case. In most States, those responsible for development and those responsible for regulatory policies have little contact.

Federal telecommunications policy is often at odds with States' economic development goals. Tension between regulatory and economic development goals was less apparent in the past because communications was not considered a key component of economic development. This tension will become more serious as the intensity of interstate and global economic competition increases and as communication is used even more for competitive advantage. It is therefore necessary to reevaluate communication regulatory policies in light of broader economic development goals, and to establish mechanisms for collaboration among players and policymakers in both of these governmental functions.

Orchestrating Change: The Role of the Federal Government

To capitalize on the potential of communication and information technologies for rural America, coordinated action is needed by many different persons, organizations, and institutions. The more broadly economic development is defined, the more varied and numerous are the participants needed for successful rural economic development. Revitalizing rural communities through communication technologies requires the cooperation and commitment of:

1. rural institutions such as schools, libraries, and medical and health providers, and the local and regional development agencies;
2. the communication providers such as the Bell operating companies, independent telephone companies, cable television and satellite companies; and
3. catalysts for change, coming, for example, from colleges or universities serving rural areas, local educational or community leaders, Federal, State, or local government, and private entrepreneurs.

If the cooperation needed for economic development is to take place, government must provide incentives for cooperation, while making it costly for players who fail to work together.

OTA field studies[6] suggest that competition for turf and economic rewards hinders the cooperation needed for economic development and limits the efficient use of communication technologies in rural areas. Many stakeholders have never dealt with one another before, and economic and political incentives are such that they are not inclined to do so now.

With the growing role of communication and information in society and their enhanced market value, the stakes involved in providing these services are higher than ever before. Since only one network may be economically feasible for a particular rural area, stakeholders will be tempted to take

[6]See appendix in the full report.

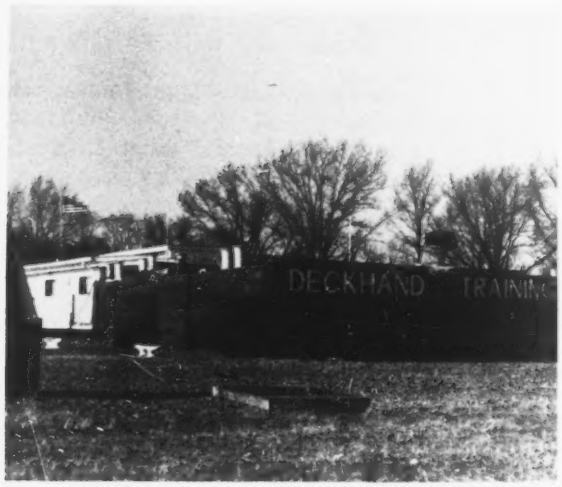


Photo credit: Mark G. Young

The Purchase Training Center outside Paducah, Kentucky, for training barge operators for the Mississippi River.

the lead in configuring and controlling the communication infrastructure for their own benefit. If the cooperation needed for economic development is to take place, government must provide incentives for cooperation, while making it costly for players who fail to work together.

Criteria for Making Policy Choices

OTA has identified a number of criteria that an economic development strategy must meet to increase its chance of success. Experience shows that whether communication technologies will be successful in promoting rural economic development depends not just on their availability to rural communities, but also on the social and economic context in which they are deployed and used. The criteria discussed below are the set of conditions that—taken together—increase the chance for success. These criteria are an interdependent, total package. To the extent that policy measures fail to address **all** of these criteria, the chance for success and the likelihood that technology will be deployed to the benefit of rural areas will be diminished.

A Vision, Together With Entrepreneurial Leadership

The notion of employing communication technologies to foster rural development is unconventional and relatively untried. To make it work requires vision, imagination, ingenuity, and enlightened leadership.

A Multidimensional, Integrated Notion of Economic Development

Experience suggests that if sustainable economic development is to occur, economic development policies and programs must be conceived in a holistic fashion. Broad-based policies are especially useful when integrating communication technologies into the development process, because these kinds of policies offer new ways for rural communities to achieve economies of scale and scope, and hence economically justify the deployment of technology.

Minimum Cost and the Effective Use of Existing Resources

With current national budget concerns, it is unlikely that there will be substantial additional resources available for promoting rural economic development, unless the value of technology deployment can be convincingly demonstrated. Development strategies, therefore, must make efficient and effective use of existing funds and institutional resources.

Flexibility To Deal With the Variety of Situations and Settings To Be Found in Rural America

Rural communities are extremely diverse; hence development policies must address the individual needs and appeal to the unique strengths of each community. Any State or Federal programs must be flexible enough to allow this.

Flexible and Creative Thinking With Respect to Rural Network Architectures

It generally takes longer to deploy technology in rural than in urban areas, so technological advances that affect rural and urban settings alike could make rural areas worse off. To improve their competitive positions, rural areas need technologies or technical capabilities that can reduce the urban advantage. Increasingly they must think about their communication systems less in terms of past urban models and more in terms of the conditions found in rural communities today.

Policies That Incorporate a Technology Transfer and Educational Component

Many rural communities are unaware of the potential of communication technologies to meet their needs and aspirations. Moreover, they are often stymied in using technology by the higher transaction costs—such as the costs of putting systems together—caused by divestiture and the unbundling of the national communication infrastructure. National development policies, therefore, must provide technical assistance and education to users to familiarize them with communication technology and assist them in planning and devising communication-based development strategies.

Reconciliation of Telecommunication Regulatory Policies and Economic Development Goals

There are a number of instances where economic development goals and telecommunication policy goals are in conflict. Ways must be found to reconcile these differences if communication technologies are to play a major role in future development programs.

Cooperation Among All Key Players

Political turf battles and intense economic competition have doomed many economic development programs in the past. If such programs are to be successful in the future, they must include all of the players and seek solutions. Incentives for such cooperation must be built into economic development strategies.

Economic Viability

The previous means of supporting rural communication systems are becoming increasingly less suitable. New ways of achieving economies of scale and scope in rural areas are needed for the future.

Allowance for Choice

Not all communities are interested in economic development. Development programs must allow communities the choice to adopt them or to opt out in accordance to their wishes.

Public Policies To Meet Development Criteria

Providing Vision and National Leadership

If Federal policymakers are to provide the vision and leadership needed to promote the effective use of communication technologies for rural economic development, they must state this objective as a major policy goal. Establishing a formal goal will signal a commitment and provide a benchmark for weighing policy choices and evaluating policy actions. A statement of goals would also provide a basis for assigning and coordinating institutional responsibilities, and for determining the efficiency and effectiveness of each program.

Failure to emphasize the potential that communication and information technologies have to improve the prospects of rural development may result in inadequate funding and a lack of institutional and human support. The Federal budget crisis makes this even more likely today. With the shrinking pie, beneficiaries of current Federal programs will lobby intensely against efforts to rethink or redirect program priorities. Opposition will be less effective if there is a clear vision of the role that telecommunication can play in promoting economic development.

Establishing formal goals is difficult. Goals focus on the question of how scarce resources should be distributed among competing groups and organizations. By not questioning goals, or by referring to them in broad terms, decisionmakers can avoid accountability to stakeholders who are losers in the goal-setting process.

It will likely be difficult to set a goal for making communication a priority in the economic development process. A consensus has not developed in the United States to support the notion of communication as infrastructure. There is an unawareness of the potential role of new communication technologies in the development process, and skepticism about its effectiveness. A few years ago, former Federal Communications Commission (FCC) Chairman Fowler equated television sets with toasters, a comparison, he said, implying that communication services should be treated like any other commodity to be bought and sold in the marketplace. This narrow view is shared by many consumers, regulators, and economists.

Being too cautious is a serious drawback. Most successful programs that have had a decidedly positive impact on rural America—such as the land-grant college system and agricultural extension, or the Rural Electrification Administration—have all been major national efforts, inspired by a larger vision.

Although the Federal rural economic development legislation enacted by the 101st Congress acknowledges the importance of and provides a specific role for communications in the development process, the bill takes a cautious approach. The Rural Economic Development Act of 1990 seeks to assure that modern communication technologies are available in rural areas by making it easier for rural telephone providers to borrow money from the Rural Electrification Administration (REA) and the Rural Telephone Bank to modernize their networks. It also calls for these borrowers to play a more active role in rural economic development. The Act further envisions the use of communication technology to achieve other economic development goals, such as improving educational and medical resources.[7] However, the Act does not provide a clear picture of the role of technology as a central force in the development process.

Being too cautious is a serious drawback. Most successful programs that have had a decidedly positive impact on rural America—such as the land-grant college system and agricultural extension, or the Rural Electrification Administration—have all been major national efforts, inspired by a larger vision.

An overly conservative approach to communication technologies could undermine the chance to make a real difference. Where communication technologies have been effective, it has often been because they served not only as more efficient means of providing basic services, but also as catalysts for innovation—for actually changing the way that things get done. People in rural areas, however, are limited in their ability to creatively apply new technologies to problems of development. They lack an adequate, low-cost communication infrastructure and the skills and experience required to optimally use it. This situation contrasts with urban areas where there is a "critical mass" of both technology and sophisticated users, which stimulates new applications and additional use. To create a "critical mass" in rural America will require a significant commitment and the willingness to take substantial risk.

Ways To Achieve Flexibility and Encourage Creativity

Policies designed to allow flexibility and encourage creativity are needed to accommodate rural America's diversity and limited experience using communication technologies to promote economic development. If communication technologies are to benefit rural communities, the 10 criteria listed above must be met. Fulfilling these criteria will require strong national leadership. The challenge for policymakers is to strike a balance between flexibility and forceful national leadership.

To achieve this balance, two different approaches have been used in the past: 1) providing block grants to the States with programmatic strings attached; and 2) establishing agencies at the State and local levels charged with administering a federally based program. The second of these two approaches is the preferred as it applies to the goal of promoting information-age technology for rural economic development. Unless the Federal Government establishes the guidelines for a technology-based program, many of the criteria needed for successful development are unlikely to be met.

The Block-Grant Approach

Block grants have been used to distribute Federal funds for health, education, and human services. This approach is increasingly being used for other funding, including rural economic development programs. For example, the Rural Economic Development Act authorizes pilot testing of an institutional framework for distributing rural economic

[7]For example, Subtitle B, Enhancing Human Resources, provides "incentives for local telephone exchange carriers, rural community facilities and rural residents to improve the quality of phone service, to provide access to advanced telecommunications services and computer networks, and to improve rural opportunities."

It is at the State level that many development programs are coordinated and priorities set.

development funding through State governments in up to five States. It establishes a new process to deliver grants and loans by creating State Rural Economic Development Review Panels[8] and/or Rural Investment Partnerships.[9] These panels would rank applications for assistance according to State needs, and allow flexibility to transfer certain rural development funds from one program to another.

Although the Secretary of the U.S. Department of Agriculture need not accept the recommendations of the State Review Panels, the Secretary would have to notify the Review Panel and the Chairmen of the Senate and House Agriculture Committee if funding decisions differed from those recommended.

State and local governments strongly favor a decentralized approach that would give them considerable control over the allocation of Federal funds. Grants and loans to the States and localities provide flexibility, allowing programs to be tailored to the specific needs of a State or local area. They also permit diversity, and the learning that comes from experimenting with different approaches. Involving State governments in the process also helps assure their commitment to Federal programs. It is at the State level that many development programs are coordinated and priorities set. State support and leadership will be essential to promote unconventional and untried development programs that rely heavily on communication technologies. Moreover, State public utility commissions set most of the regulatory policies affecting rural economic development. Therefore, it will be the State governments that must reconcile economic development and regulatory policies and goals.

Although favorable to the States, block-grant programs may not allow room for sufficient Federal leadership. As more responsibility is shifted to the States, the Federal Government will find it more difficult to assert leadership, guide programs, or meet national priorities. Without strong Federal leadership, many prerequisites for successful development will not be met.

For example, with a block-grant program, it would be difficult to assure that States pursue development approaches based on the use of communication technologies. Established interests are well-positioned at the State level to vie for Federal funds. But there are few constituent groups to speak on behalf of using communication technologies as a development tool. Nor are many State officials either well versed in the use of technology or aware of the development opportunities and choices that it offers. In general, States will find it difficult to provide the entrepreneurship or vision required to overcome entrenched interests and the traditional ways of doing things.

Block grants are unlikely to provide either sufficient incentives to encourage holistic approaches to development or sanctions to discourage States from simply "writing off" their most depressed communities.

Block grants are also unlikely to provide either sufficient incentives to encourage holistic approaches to development or sanctions to discourage States from simply "writing off" their most depressed communities. Many States focus their development efforts exclusively on the business sector, and they favor those regions in their States that offer the most commercial promise. This tendency is likely to be more prevalent in the future as States compete even more intensely to attract new businesses and jobs. Communication technologies will be underutilized, serving only a narrow set of business interests, while other important aspects of community development founder.

[8]The partnerships would provide local revolving funds for rural development, with Federal seed money available to State and local government and nonprofit public or private rural economic development agencies.

[9]The "Rural Partnership Investment Board" would be composed of the Administrators of the Rural Electrification Administration, Rural Development Administration, and Extension Service plus two other members appointed by the President. The Board would provide Federal lines of credit; local agencies administering the funds would make the investment decisions.

If the Federal Government is to pursue a development program based on block grants, it must assure that States have the technical capacity to make educated decisions about the use of technology. Moreover, funding would need to be made conditional on its use for specific purposes.

A Federal Program Administered at the State Level

One way to provide both Federal leadership and flexibility at the local level is to build on the successful model of the Cooperative Extension Service. Through this program the Federal Government played a major role in transferring industrial technology to agriculture. Cooperative Extension was successful because it relied on participative, self-help programs—farmers working together with experts and officials to solve problems.

An equivalent program today would be a Rural Development Service, whose basic mission would be to encourage the use of communication technologies for development purposes. As in the case of its agricultural model, administrative units would be established at the Federal, State, and local levels, but program activities would vary from State to State and within States. Decisions would be worked out locally and flow upward through the system to the State level. Subject matter specialists, who might be employed by land-grant institutions, would help local development officials incorporate communications into their programs. Supervisors and State leaders would assist in program planning, budgeting, and public relations. The Federal Government's role would be largely one of consultation and leadership, rather than of direct management or control.

This option would signal a true commitment to promoting rural development through information-age technologies. It is also a proven method for technology transfer, a major need for a successful program. The previous success of this kind of a program suggests it is likely to have a considerable payoff.

States, however, may not favor this approach, especially if it is seen as an alternative to receiving block grants. Many State leaders may not view telecommunications as a major priority. Others may simply want to control funds spent within their jurisdictions. One way to overcome such resistance would be to separate out Federal funding for telecommunications programs from other grants and to link these funds to State support and commitment.

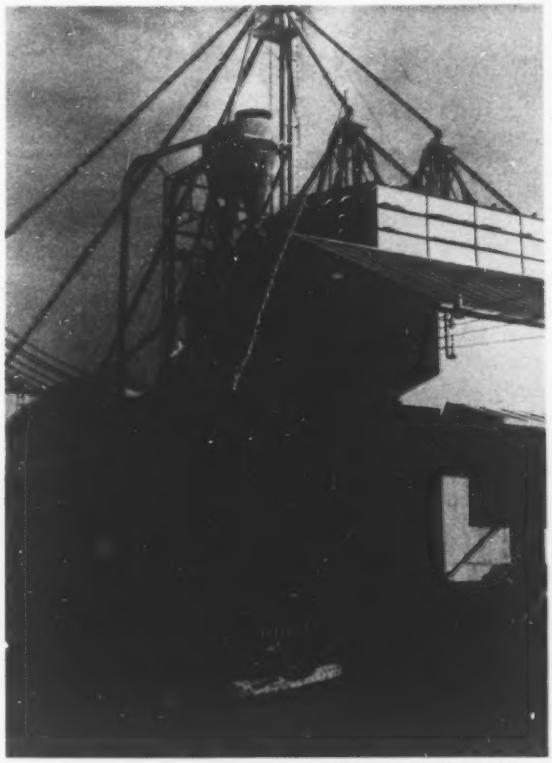


Photo credit: Mark G. Young

The farm bureau and cooperative in Page, VA.

This approach may be difficult to execute through existing organizations. Even within Federal agencies, there is little understanding of communication technologies and their potential. Success will depend on how willing and able agency employees are to improve their technical knowledge or to hire those knowledgeable in this area. If new organizational arrangements are required, the cost of pursuing this option will be greater.

Taking Advantage of Existing Organizations

A national program to encourage the use of information technology for rural economic development will be less costly if existing organizations are given charge of its direction and implementation. There are a number of organizational candidates for this task, including a wide variety of agencies and institutions involved in development activities at the Federal, State, and local levels. Each, however, is

generally responsible for only one piece of the development puzzle. Thus, the problem for policymakers is not to establish new institutional arrangements, but to assign agencies tasks that match their existing strengths and to assure that cooperation and coordination among these agencies provides a holistic development approach.

There are at least three organizations that could be considered for major rural development roles (see figure 6). These include the United States Department of Agriculture, the Rural Electrification Administration, and the State land-grant colleges and university systems.

The United States Department of Agriculture

The Department of Agriculture (USDA) is responsible for coordinating rural policy, and chairs the interagency committee on rural development that operates under the auspices of the White House Economic Policy Council. Over the last few years, it has made a concerted effort to expand its focus beyond agriculture-related issues to include more general economic development issues affecting rural areas. Several USDA agencies now have important rural development responsibilities—principally the Farmers Home Administration, the Rural Electrification Administration, and the Cooperative Extension Service, and—to a lesser extent—the Forest Service, Soil Conservation Service, Economic Research Service, and the National Agricultural Library.

If USDA is to play a commanding role in rural development, even greater leadership and coordination is needed. Title XXIII of the Rural Economic Development Act of 1990 (Public Law 101-624) reorganizes the Department of Agriculture to do this by creating the Rural Development Administration alongside the Farmers Home Administration to be vested with primary responsibility for rural economic development policy.

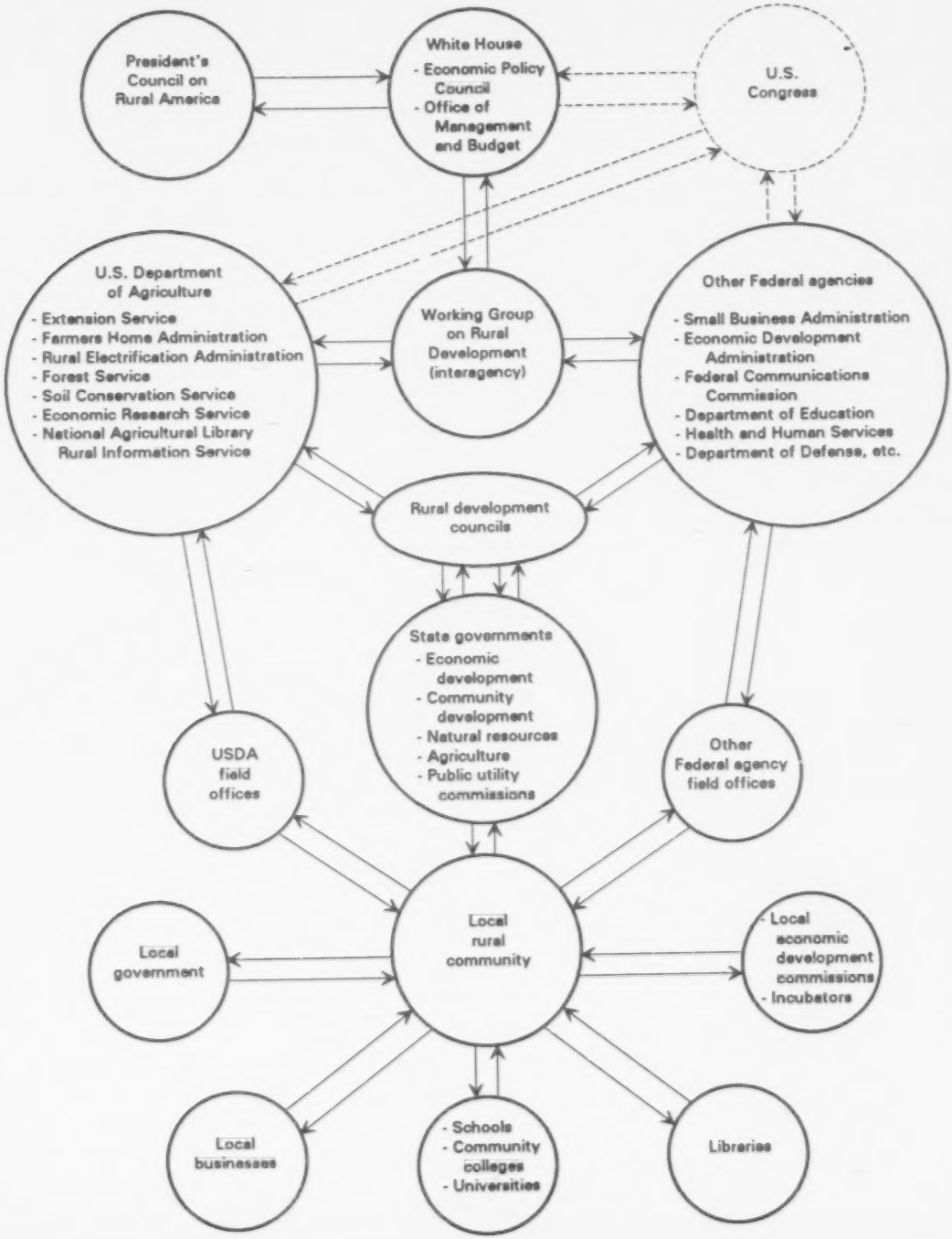
Within USDA, the Economic Research Service conducts research on rural areas, and its work has identified and explained the underlying causes of rural America's recent decline. Further research, monitoring, and examining the role of communication in the development process at the local level could also be fruitful. Section 2349 of the Rural Economic Development Act provides research grants for the purpose of further studying rural development. In addition, it directs the National Rural Information Center Clearinghouse operated by the National Agriculture Library to maintain and disseminate information on various leadership training programs, as well as information on participants involved in rural development. The listing is to include information about rural electric cooperatives; nonprofit business development companies; economic development districts serving rural areas; small business development centers; regional development organizations; vocational or technical schools; and Federal, State, and local agency programs.

If the Cooperative Extension Service is to play an expanded role in introducing information-age technology to rural areas, it must be reenergized and develop greater technical expertise, especially at the grassroots level.

The Cooperative Extension Service is part of the Department of Agriculture. This program is uniquely suited to help introduce information-age technologies to rural areas where unfamiliarity and lack of experience with communication technology is a major barrier to its use. Knowledge is rarely transferred passively. Moving innovations from development to production is not a one-way process. The experience and understanding of potential users is as important to the process as is expert knowledge. Thus, effective technology transfer requires outreach programs based on mutual trust and respect, similar to those administered by the Cooperative Extension Service.

However, while the Cooperative Extension Service has a rural development strategy at the national level, at the grassroots level it is often not perceived as a vital institution, with an important mission to fulfill. Instead, it is viewed as lacking creativity and initiative, and focused on agriculture to the exclusion of other kinds of rural development problems. Federal Extension Service officials, now more aware of the potential role for communication technologies in the development process, are developing an

Figure 6—Organizational Chart of Agencies Involved With Rural Development



The key players involved in rural development at the Federal, State, and local level, and how they relate to each other.
SOURCE: Office of Technology Assessment, 1991.

overall information technology plan.[10] But the knowledge gap at the local level is great. If the Cooperative Extension Service is to play an expanded role in introducing information-age technology to rural areas, it must be reenergized and develop greater technical expertise, especially at the grassroots level. It also must work more closely with other rural development agencies, such as the Rural Electrification Administration, the Economic Development Administration, the Small Business Administration, and statewide university systems.

The Rural Economic Development Act of 1990 takes steps to enhance the role of the Cooperative Extension Service. Section 2346 establishes a rural economic and business development program within the Extension Service. Funds are provided for State and county-level Cooperative Extension Service rural development specialists to:

> Assist individuals in creating new businesses, including cooperatives, or assist existing businesses, and to assist such businesses regarding advanced telecommunications, computer technologies, technical or management assistance, business and financial planning, and other related matters, and to assist community leaders in community economic analysis and strategic planning.

Rural development specialists would provide:

> Advanced telecommunications, business management, computer operations, and other technical assistance to community leaders and private sector entrepreneurs and cooperatives.

The Extension Service is also directed to coordinate and cooperate with any similar service provided by other Federal agencies or programs.

The Rural Electrification Administration (REA)

Like the Cooperative Extension Service, the REA has a long and successful history serving rural communities. Its basic charge was to foster technology deployment through a low-cost Federal loan program. Communication services in rural areas would have lagged greatly had rural telecommunication providers not used REA loans.

Although the REA program has helped rural telephone providers make strides in upgrading the rural communication infrastructure, there is still much for REA to do. Many areas continue to have poor-quality service. Many do not have single-party access to the public switched network, equal access to competitive long-distance carriers, access to value-added data networks, emergency 911 service or touch tone and customized calling services. Moreover, rural communication needs are likely to increase greatly in the future due to the rapid advance of technology and the importance of communication in modern life. Experience suggests that advanced technologies will not be quickly deployed to rural areas without some form of government intervention.

REA could help rural communities and development agencies serving rural areas sort out their communication needs and explore new ways of meeting them.

There are also new roles that REA could play in the post-divestiture communication environment. Most important, REA could help rural communities and development agencies serving rural areas sort out their communication needs and explore new ways of meeting them. If rural areas are to benefit from new technologies, they must develop alternatives for organizing and financing their communication networks. Fortunately, technological advances and the unbundling of the communication infrastructure permit all users to develop customized communication systems that meet their unique needs.

With its successful lending experience and technical expertise, REA could play a key role in helping to launch such experimental approaches. The REA could establish forums and discussion groups of community leaders, communication providers, and communication users to consider rural communication needs, and explore how communication systems might be designed to meet these needs. In a more proactive mode, REA might conduct research and development to investigate new and creative ways of deploying advanced communication and information technologies to rural areas, and/or provide financial support for demonstrations and trials of such strategies. The REA could serve as an honest

[10]For a discussion of this plan see ch. 6 in the full report.

broker between borrowers and potential users. It could also provide loans and technical assistance to groups of users and providers who undertake cooperative communication ventures.

The Rural Economic Development Act of 1990 includes measures to expand REA's role in several of these respects. Section 2350 creates a new REA Assistant Administrator for Economic Development to carry out REA programs that involve rural electric and telephone systems in community and economic development. This section mandates REA to spend 10 to 20 percent of its annual budget on development activities, and not less than 1 percent on a "technical assistance unit" to provide advice and guidance to REA borrowers concerning community and economic development. Section 2345 provides the REA Administrator with additional powers and assigns duties to provide advice and guidance, establish and administer pilot projects and demonstrations, and act as an information clearinghouse for dual development-related activities of REA borrowers. REA's technical assistance role is strengthened across the board.

The Act reaffirms the continuing importance of the REA loan program, and calls on it to play an even greater role. Public Law 101-624, for example, finds that:

> Making modern telecommunications technology and services available in rural areas in the United States promotes economic development and improves the quality of life in rural areas, and the efficient operation of the Rural Telephone Bank and the Rural Electrification Administration loan program is essential to the continued development of the telecommunications infrastructure in rural areas.

The Act extends lending authority to advanced telecommunication services; mandates the expeditious processing of loan applications and the use of available loan funds to the extent authorized by law; and prohibits, in the strongest possible terms, any further attempts to dismantle or weaken REA and REA telephone programs. In addition, Section 2101 of Title XXI establishes a technical assistance unit within REA to provide advice, guidance, and information to REA electric and telephone borrowers concerning rural development programs, activities, and projects. It also directs REA to "promote local partnerships and other coordination between borrowers under this Act and community organizations, States, counties, or other entities, to improve rural development."

The REA is well-suited to assume leadership in planning for, and supporting, rural communication networks for the future.

The REA is well-suited to assume leadership in planning for, and supporting, rural communication networks for the future. Moreover, the creation of an economic development office within the REA is consistent with the criteria calling for a joining of economic development and technology policy. However, REA is likely to be most effective when focusing on technology issues. As it now stands, it has neither the staff nor the resources to play a major economic development role. Thus, it may be best not to recast REA into a full-blown rural development agency, for which it is ill equipped, but instead to direct REA to work closely with other agencies, focusing and providing expertise and advice on the many new and challenging technology issues emerging in a post-divestiture environment.

Dispersed throughout rural areas, institutions of higher education provide an ideal hub, not only for rural communication networks but also for bringing together the myriad of players needed for economic development.

Community Colleges, Land-Grant Universities, and State University Systems

Although colleges and universities played a critical role in helping Americans adjust to the shift from an agricultural to an industrial-based economy, they are sometimes overlooked as resources for rural economic development. In the Rural Economic Development Act, educational institutions are hardly referred to at all, at most being called on to play a coordinating, research, and/or limited implementa-

tion role.[11] This is a serious oversight. Dispersed throughout rural areas, institutions of higher education provide an ideal hub, not only for rural communication networks but also for bringing together the myriad of players needed for economic development.

Many colleges and universities already have computer/communication networks that are electronically linked to other institutions, libraries and databases, and research centers throughout the United States and the world. The future development of a high-speed national research and educational network (NREN) will provide universities even greater access to computing and transmission capacity, and information services. In addition, the number of educational institutions using communication technologies to develop and share educational resources and materials is growing at a steady pace. Many colleges now deliver at least some classes over the air or online to students at distant locations.

Having established their own communication networks and successfully used them to meet their educational goals, most educational institutions are knowledgeable in the use of communication technologies.

Having established their own communication networks and successfully used them to meet their educational goals, most educational institutions are knowledgeable in the use of communication technologies. As large users of communication services—often ranking second only to State government—they exert considerable market power. As in the case of a large business, the demand of a statewide university system can, by itself, justify the deployment of advanced technology even to a relatively remote area. Because of these strengths, educational institutions can play a key role in assuring the success of telecommunication-based development programs. Not only could they provide expertise, they could also leverage their market power to draw communication providers to rural areas (see box F).

Colleges and universities also provide a locus for many of the key players involved in development. Businesses are now aligning themselves with educational centers to promote education, training, and research. They are also taking advantage of university online library systems and the growing number of applied research and development centers located at, or near, university centers. Similarly, many organizations involved in development are either housed at or near the university. For example, the Small Business Administration's (SBA) offices are generally located on university campuses. So too are many Extension Service's offices. Universities are also well connected to State governments, since many are governed by State boards and funded by the States.

Federal regulatory policies that aim to guarantee rural areas equal access to advanced technologies may founder because regulatory authority is divided between the Federal Government and the States.

Thus State colleges and university systems could contribute to the rural economic development process. Federal and State programs that do not include them will lose a powerful resource.

Reconciling Economic Development and Regulatory Policies

It is a mistake to use the regulatory system as the primary means for achieving rural economic development. Regulators and economic developers have different missions. They often view issues and judge policies in different terms. These differences are even greater in the post-divestiture, competitive environment. Regulators are committed to protecting individual consumers; economic developers to

[11]The Act requires that any State Rural Economic Development Review Panels that may be established include nonvoting representatives from schools or colleges of business, engineering, and agriculture. Also, the Act establishes rural telecommunication access programs intended to improve the use of telecommunication and computer networks by rural students and teachers, among others. And education is to be included in rural development plans proposed for rural areas in participating States.

Box F—Big Sky Telegraph

In Cody, a remote town in northern Wyoming, stands an old log house. What was once a mid-fifties Holiday Inn coffee shop now encloses the Big Horn BBS [computer "bulletin board system"], *a rather unlikely location for a telecommunications system with global capabilities.*[1]

Ever since the inception of the Big Sky Telegraph at Western Montana College introduced the idea of linking citizens and communities through modern telecommunications, there has been a proliferation of BBSs around these Northern Mountain States, where people are spread over great distances.

Big Sky Telegraph, the inspiration and model for other bulletin board systems in Colorado, Wyoming, Idaho, and Nebraska, was first conceived as an electronic network to link Montana's 114 one-room schools to each other and to Western Montana College. With initial support from the M.J. Murdoch Charitable Trust and US West, Big Sky started operating—"went on line"—in January 1988. The Telegraph has gone beyond being "a resource support system and recertification program for teachers"[2] and its mission has since grown into "a rural educational, business, and individual telecommunications support service." About 100 community sites (including schools, libraries, county extension offices, chambers of commerce, women's centers, and hospitals) will be equipped with a modem to connect their computers to Big Sky's network. Circuit riders travel throughout the State to introduce people to the technology and familiarize them with its offerings, and local system operators are given training to help the community use the services.

The Big Sky Telegraph exemplifies how communication technologies serve to support human communication which ultimately and essentially serves to define and unite communities. Big Sky is a means of sharing ideas and information among communities with common circumstances and concerns and similar needs and opportunities—but which are separated by great distances. "The Big Sky Telegraph 'virtual community of communities' consists of frontierspeople from over 100 rural Montanan communities and statewide dispersed organizations working together to learn from each other survival techniques."[3]

The Telegraph is a tool for enhancing education, for broadening and strengthening community, for facilitating economic development, and for building grass-roots democracy. For example, several students are being taught a class in Chaos Theory from a professor at the Massachusetts Institute of Technology over the Big Sky Telegraph. In addition, the Telegraph will give subscribers to the system access to a greater range of external and foreign information sources such as national and international databases and computer bulletin boards.

Photo credit: Frank Odasz

Members of three tribes at work during Big Sky's recent project, the Native American Graphic workshop.

[1]Lester Santos, "The Conception and Development of the Big Horn Community Business BBS," unpublished paper.

[2]MESA Consulting, "Telecommunications and Rural Economic Development," prepared for United States Telephone Association, October 1990.

[3]David Hughes, "On the Trail to the Rural Global Trade Frontier: Tales From the Telecom Trappers Council," unpublished paper.

SOURCES: Big Sky Telegraph, "Telecommunications Guide to Community Action," © Frank Odatz, University of Montana, Western Montana College; David Hughes, "On the Trail to the Rural Global Trade Frontier: Tales From the Telecom Trappers Council," unpublished paper; Lester Santos, "The Conception and Development of the Big Horn Community Business BBS," unpublished paper; MESA Consulting, "Telecommunications and Rural Economic Development," prepared for United States Telephone Association, October 1990.

Communication policies now being debated and decided will determine when, and to what extent, rural areas have access to modern communication technologies.

fostering broader societal goals. Whereas regulators tend to assess the need for deploying new communication technologies on the basis of a demonstrated market demand; economic developers tend to evaluate the benefit in terms of technology's potential to address a social problem.

Federal regulatory policies that aim to guarantee rural areas' equal access to advanced technologies may founder because regulatory authority is divided between the Federal Government and the States. Even when the Federal Communications Commission adopts policies to encourage the modernization of the communication infrastructure—as in the case of setting depreciation rates[12]—States may not follow suit. Recent court decisions have circumscribed the FCC's authority to preempt the States in such instances.

Despite the problems entailed in relying on regulation, rural economic development must take telecommunications policy and regulatory policy goals into account. Communication policies now being debated and decided will determine when, and to what extent, rural areas have access to modern communication technologies. Thus, if communication-based rural economic development policies are to succeed, the conflict between economic development and communication regulations must be reconciled. There is too little attention being paid to these issues. The recently enacted Rural Economic Development Act, for example, does not address the potential communication regulatory issues that the legislation might cause, nor does it suggest ways to resolve them.

Several steps might be taken to remedy this situation:

Photo credit: Mark G. Young

A view of the main street in Ritzville, Washington, a community heavily dependent on agriculture.

1. establish institutionalized ways to improve communication between economic development policymakers and regulators,
2. take better advantage of the Federal/State joint board (see below) to resolve differences on technology deployment,
3. give regulatory agencies authority to include development goals in their evaluations,
4. pursue technology deployment strategies that are likely to work through—not against—market forces, and
5. set regulatory policies that distinguish rural from urban areas.

Establish Institutionalized Ways To Improve Communication Between Economic Development Policymakers and Regulators

Regulators and policymakers involved in economic development would better understand each other's values and goals if they routinely met to discuss overlapping issues. A typical way of promoting such discussion is to set up an interagency

[12]Beginning in 1980, the FCC adopted a number of changes with respect to determining depreciation rates that were designed to take into account advances in technology. This step led, however, to conflicts with the State public utility commissions. The Supreme Court supported the States' rights to an independent position, ruling—in the case of *Louisiana Public Service Commission* v. *Federal Communications Commission*—that in the 1934 Communication Act, Congress did not want to preempt the States on depreciation issues generally.

Regulators and policymakers involved in economic development would better understand each other's values and goals if they routinely met to discuss overlapping issues.

committee.[13] In this case, an interagency group might be established between the Federal Communications Commission (FCC) and the Rural Development Administration within USDA. Interagency committees are often formed for expedience.[14] They seldom reach consensus; but they can promote shared understanding. Such arrangements are rarely satisfactory, so interagency committees should be viewed as a complement to other mechanisms.

Some of the shortcomings of interagency committees are that they tend to obscure problems rather than resolve them, subvert the political interest and commitment to addressing problems because there are too many people with peripheral interest, and seek outcomes based on a distribution of power instead of policy needs.[15] Mission agencies often oppose such coordination and set out to assure that they fail. As Harold Seidman has noted, efforts at coordination are not designed to make friends, for "coordination is rarely neutral," and always "advances some interests at the expense of others."[16] Thus, any proposal to improve coordination is often judged less on its merits than on how it might redistribute power among existing players.

Interagency groups work best when aiming towards established goals. They may be only marginally effective in resolving rural economic development/telecommunication policy issues unless the goals are clearly stated. Interagency committees should not be discounted, however. Without a dialogue between policymakers in both development and regulation, it may not be possible to find solutions.

Utilize Joint Federal/State Boards To Foster Communication Among Federal and State Regulators About Meeting Rural Communities' Communication Needs

States are pursing a number of different approaches to reduce the tension between economic development and regulatory goals. Some of these conflict with the policies and approaches of the FCC. Sharing experiences on the State and Federal levels through a joint forum might help reconcile and resolve jurisdictional issues.

The Federal/State Boards sponsored by the FCC and the State public utility commissions may be appropriate forums for these discussions. The boards consist of three FCC commissioners and four State commissioners nominated by the National Association of Regulatory Utility Commissioners. They consider divisive State-Federal issues and bargain in ways similar to contract negotiations. Most participants agree that the joint board process has been useful.[17]

If rural economic development is considered a major national goal, Congress could direct FCC to also consider social goals in its evaluations.

Give Regulatory Agencies Authority To Include Development Goals in Their Evaluations

Regulatory agencies are constrained by law as to the criteria they can apply to regulatory decisions. For example, some State regulatory commissions are prohibited from considering anything but tech-

[13]Today, two intergovernmental agencies are concerned with communication and communication-related issues: The Senior Interagency Group on International Communication and Information Policy, which was established by the National Security Council in 1984; and the Economic Policy Council, which, although it does not directly focus on communication issues, provides an interagency forum for addressing them.

[14]As Harold Seidman has described them, "Interagency committees are the crabgrass in the garden of government institutions. Nobody wants them, but everyone has them. Committees seem to thrive on scorn and ridicule, and multiply so rapidly that attempts to weed them out appear futile." See, Harold Seidman, *Politics, Position, and Power: The Dynamics of Federal Organization* (New York, NY: Oxford University Press, 1980), p. 270.

[15]Alan Schick, "The Coordinating Option," in Peter Szanton, *Federal Reorganization: What Have We Learned?* (Chatham, NJ: Chatham House Publishers, 1981), p. 95.

[16]Seidman, op. cit., footnote 14, p. 205.

[17]Richard Schultz, "Two-Tier Regulation and Joint Boards in American Telecommunications," unpublished manuscript, July 1987.

nology cost/benefits and may not include social costs and benefits. This makes it impossible to account for economic development goals in regulatory decisions. Even in cases where consumers may benefit socially, regulators' choices are limited. Some States—such as Michigan—have passed laws authorizing their State regulators to incorporate social goals in their analyses to avoid this obstacle. If rural economic development is considered a major national goal, Congress could direct FCC to consider social goals in its evaluations. The FCC is now prohibited from actively supporting economic development. Congress has been reluctant to act on communication issues. If this reluctance continues, a change in FCC's authority is unlikely.

Encourage Technology Deployment Strategies That Will Work Through—Not Against—Market Forces

Regulators do not disagree with social goals per se, but they generally oppose policies that circumvent market forces or that distort market signals. They encourage modernization programs that are driven by demand, rather than technology. Economic development strategies that create demand are consistent with regulatory policies. For example, strategies that combine users' needs and create the demand needed to financially justify the rapid deployment of advanced communication technologies will meet regulatory criteria.

Changes will require government intervention. Consumers act as individuals in the market, with no incentive to join together. Consumers may not recognize their common interests in rural areas where communication expertise is limited. Government could provide incentives to assist consumers through information sharing and/or loans and grants. The REA could play an important role in providing technical assistance.

Section 2334 of the Rural Economic Development Act encourages joint use and sharing of telecommunication transmission facilities through grants to end users. The Act also streamlines the process for granting telephone carrier loan requests and requires grant applicants to work with local telephone carriers. Section 2337 creates a loan program for business telecommunications partnerships to help rural businesses and governments share telecommunications terminal equipment, computers, and computer software.

Although consistent with regulators' compulsion to work through the market, a cooperative approach could still raise regulatory problems. A large and coordinated group of users could establish its own communication system and bypass the public network.

Regulatory Policies That Distinguish Rural From Urban Areas

Conditions in rural areas are dramatically different from those in urban areas. This difference requires different telecommunications strategies. Regulatory policies must be designed to reflect these differences. Policies that pertain to lower Manhattan in New York City are not likely suitable to Aroostook County, Maine. Whereas Manhattan can sustain three competing telephone companies, Aroostook County barely sustains even one modern communication system. Rate-of-return regulation, depreciation policies, alternative regulatory frameworks, cable/telco cross-ownership, telephone companies entry into information services, and LATA boundaries and exchange boundaries require special treatment for rural areas. To address these policies, Federal-State jurisdictional conflicts must be resolved, and sensitivity to rural needs must be nurtured among regulators.

Federal-State jurisdictional conflicts must be resolved, and sensitivity to rural needs must be nurtured among regulators.

Creating Incentives for Cooperation

Communication-based economic development programs are likely to have substantial long-term benefits. But some stakeholders may feel threatened. Agencies may try to protect their turfs or may lack the willingness to acquire the technical know-how. Telephone service providers might be concerned that users bypass their communication systems. State development officials may resent loss of control over development funding. Local development groups may resist new programs seeking a share of development funds. The cooperation needed for rural success is unlikely in such a competitive atmosphere. The Federal Government must promote

cooperation among stakeholders by using its leverage through grants and loans.

Educators lead in developing this kind of cooperative approach. Under the Star School Program, for example, $33.5 million (in the form of 2-year competitive matching grants) is available to partnerships for using telecommunications for long-distance learning.[18] Taking advantage of a similar opportunity, the University of Maine/Telecommunications System used a 5-year, $4.4 million grant from the Department of Education under Title III of the Higher Education Act, matched by the State government, to help telephone providers pay for the upfront costs of deploying a fiber network linking State universities and community colleges.

A similar grant or loan program might be administered through the USDA's Rural Development Administration, which coordinates Federal activities in rural economic development. However, the interagency working group that exists within USDA should be expanded to include the Departments of the Interior and Defense and the FCC. Loans might be administered through the REA.

Government must promote cooperation among stakeholders by using its leverage through grants and loans.

If effective, these grants could have a very high payoff. Such grants could help establish self-sustaining relationships that promote cooperation and commitment among players. The Federal Government could guide the grant program through a competitive process. The Federal Star School Program identified the players that must be involved in developing educational partnerships, and targeted benefits for low-income groups; a rural grant program could similarly require that certain criteria be met.

Programs and partnerships developed under such a grant or loan program could prove threatening to rural communication providers, and cause some tricky regulatory problems. There are bound to be some failures with this unconventional approach. However, something can be learned from failure in such high-risk programs, and the experience gained can be built into later grants. Moreover, the rate of failure is likely to be less if this kind of program is implemented in conjunction with the necessary informational, technology transfer activities. Regulatory problems might also be resolved if Federal plans are discussed regularly with State regulators. Conflicts with local communication providers will be avoided, if they are participants in the development of any grant proposals, and thus have something to gain by their acceptance.

[18]The Star Schools legislation specifies two formats for the composition of eligible partnerships. In one, membership must include at least one State educational agency, State higher education agency, or local education authority responsible for a significant number of poor or underserved students. Furthermore, this type of partnership is required to have at least two other institutions from a host of types, including universities, teacher training institutions, and public broadcasting entities. The other type of partnership must include a public agency or corporation already formed to operate or develop telecommunication networks to serve schools, teacher training centers, or other education providers. All partnerships must be statewide or multistate. These requirements were meant to create new paths to improve the educational system by fostering cooperation among institutions. For a further discussion, see *Linking for Learning*, OTA-SET-430 (Washington, DC: U.S. Government Printing Office, November 1989), pp. 136-141.

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- **Informing the Nation: Federal Information Dissemination in an Electronic Age.** Identifies and describes the current institutional base for Federal dissemination of public information; assesses the current technological base and future technical developments; evaluates present and future public information needs and how technology might help meet such needs; and identifies and analyzes key issues and options. OTA-CIT-396, 10/88; 344 p.

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- **Technology and the American Economic Transition: Choices for the Future.** Analyzes changes to the American economy by examining products and services, the effects of new technology on society and the economy, and national policy decisions that may be needed to exploit the opportunities technology can offer and protect the country from potential adverse consequences. OTA-TET-283, 5/88; 512 p.

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- **Worker Training: Competing in the New International Economy.** Explores the connections between new workplace technology, employee training, and competitiveness. Examines the national investment in training of active work forces; the delivery system for employee training; instructional technology and research needs in work force training; employee training and adjustment to technological change; demographic changes in the work force and their implications for training; and employee training in countries that are major industrial competitors of the United States. OTA-ITE-457, 9/90; 290 p.

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  GPO stock #052-003-01214-6; $12.00 per copy
  NTIS order #PB 91-106 716/AS

- **Technology and Structural Unemployment: Reemploying Displaced Adults.** Assesses the reasons and outlook for adult displacement, evaluates the performance of programs to serve displaced adults, and identifies options to improve service. The report also examines trends in international trade and their effects on worker displacement. OTA-ITE-250, 2/86; 448 p.

  Free summary available from OTA.
  NTIS order #PB 86-206 174/AS

- **Plant Closing: Advance Notice and Rapid Responses—Special Report.** Explores the benefits and costs of advance notice for plant closings and permanent layoffs and examines the ability of public agencies to provide worker adjustment services rapidly and effectively when employers do give notice. OTA-ITE-321, 9/86; 68 p.

  NTIS order #PB 87-118 212/AS

- **Displaced Homemakers: Programs and Policy—Interim Report.** Focuses on problems and performance of Federal support for displaced homemakers. OTA-ITE-292, 10/85; 44 p.

  NTIS order #PB 86-120 276/AS

- **Networking the Nation: The National Research and Education Network.** This study assesses the issues surrounding data networking for science and the potential for such networks to serve the broader needs of education. In progress.

NOTE: Reports are available from the U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402-9325, (202) 783-3238; and/or the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161-0001, (703) 487-4650.

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